



THE HIGHS AND LOWS OF ENGINEERING FLIGHT

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412TW-PA-19370

So you WANNA fly HIGH, do ya???



NOOOO?

OH! ... You want to fly LOW



Mission Considerations

▶ I. Why Fly HIGH?

- ▶ A. You can see FAR away (Reconnaissance)
- ▶ B. You can fly out-of-reach (of enemy missiles and bullets)

▶ II. Why Fly LOW?

- ▶ A. Not as easily seen ("Element of Surprise")
- ▶ B. Very low = more challenging for enemy to shoot the aircraft (Self-Protection)
- ▶ C. Closer may = better accuracy
- ▶ D. Make an "impression!"



Physical and Engineering Considerations: Aerodynamic / Flight Control

HIGH ALTITUDE

- ▶ Thinner Air means LESS LIFT under wings
- ▶ Thinner Air means turns are wider
- ▶ Aircraft Stall risk is greater
- ▶ Fuel burn is better

LOW ALTITUDE

- ▶ Thicker Air means MORE LIFT, better climbing and turning
- ▶ Tighter turns means HIGHER "G's"
- ▶ Stall risk less, but ...
- ▶ More fuel is burned

Physical and Engineering Considerations: Human Factors



The HIGHER you fly, the COLDER !!!

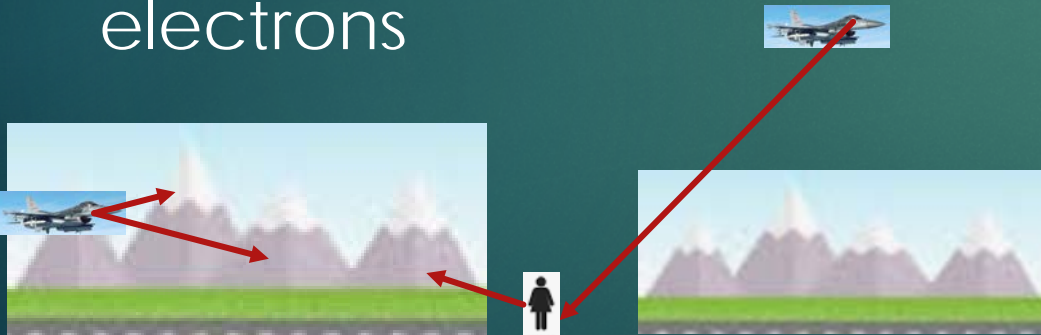
HIGHER = Less Air Pressure,
Less Oxygen



Above "ARMSTRONG's Line"
body fluids will "BOIL" !!!

Physical and Engineering Considerations: Electrons

- ▶ What are electrons?
- ▶ When / Why do we use them?
- ▶ Free-space electron travel
- ▶ How altitude affects use of electrons



Altitude Summary

- Altitude affects mission
- Altitude affects flight control
- Altitude affects humans
- Altitude affects electronics

QUESTIONS ??



REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.					
1. REPORT DATE (DD-MM-YYYY) 09-07-2019		2. REPORT TYPE PowerPoint Slides		3. DATES COVERED (From - To) 10 July 2019	
4. TITLE AND SUBTITLE Flight Engineering considerations of Altitude				5a. CONTRACT NUMBER N/A	
				5b. GRANT NUMBER N/A	
				5c. PROGRAM ELEMENT NUMBER N/A	
6. AUTHOR(S) Wesley A. Ardt, NH-03, USAF				5d. PROJECT NUMBER N/A	
				5e. TASK NUMBER N/A	
				5f. WORK UNIT NUMBER N/A	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) AND ADDRESS(ES) Junior Test Pilot School Plant 42 2503 E Ave P Palmdale, CA 93550				8. PERFORMING ORGANIZATION REPORT NUMBER 412TW-PA-19370	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) 412th Test Wing 195 E Popson Ave Edwards AFB CA 93524				10. SPONSOR/MONITOR'S ACRONYM(S) N/A	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S) N/A	
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release A: distribution is unlimited.					
13. SUPPLEMENTARY NOTES This presentation is to elementary or junior high/middle school students.					
14. ABSTRACT Presentation will instruct very basic STEM principles in how engineers must consider altitude factors when designing aircraft and components for flight. No reference to any test projects or talk around classified information is involved. Topics covered will be: Why fly high; Why fly low? Mission considerations: Flying higher allows systems to see farther, and you might be out of the reach of enemy weapons. Flying lower can allow system to use terrain to hide from enemy eyes. Flight performance considerations: Higher altitude means less positive control, but better fuel efficiency; Lower flight means better control, but worse fuel efficiency. Human considerations: Oxygen and pressure are lower at high altitudes; Above Armstrong's Line, body fluids can "boil." We use electronics to communicate and detect, but electronics don't stop at high altitudes; At low altitudes, terrain affects them.					
15. SUBJECT TERMS Altitude, Armstrong's Line, G-forces, free-space propagation					
16. SECURITY CLASSIFICATION OF: Unclassified			17. LIMITATION OF ABSTRACT None	18. NUMBER OF PAGES 10	19a. NAME OF RESPONSIBLE PERSON 412 TENG/EN (Tech Pubs)
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER (include area code) 661-277-8615